Time Value of Money - Six Functions of a Dollar
Appraisal Training: Self-Paced Online Learning Session

Lesson 3: Present Worth of $1

Problem 1

Calculate the present value (*PV*) of each future value (*FV*) listed below using the present worth of $1 (*PW*$1) factors in AH 505:

	FV	*n* (years)	Annual Rate (%)	*PV* = *FV* × *PW*$1
1	$1,000	5	3	
2	$100,000	5	4	
3	$1,000,000	20	5	
4	$20	5	4	
5	$1,000,000	10	10	

Solution:
To solve, calculate the present value of each future value amount by multiplying the amount by the present worth of $1 factor found in the AH 505 annual compound interest tables for the given interest rate and term.

1. *PV* = *FV* × *PW*$1
   PV = $1,000 × **0.862609** (AH 505, page 21, column 4)
   PV = $862.61
2. *PV* = *FV* × *PW*$1
   PV = $100,000 × **0.821927** (AH 505, page 25, column 4)
   PV = $82,192.70
3. *PV* = *FV* × *PW*$1
   PV = $1,000,000 × **0.376889** (AH 505, page 29, column 4)
   PV = $376,889.00
4. *PV* = *FV* × *PW*$1
   PV = $20 × **0.821927** (AH 505, page 25, column 4)
   PV = $16.44
5. *PV* = *FV* × *PW*$1
   PV = $1,000,000 × **0.385543** (AH 505, page 49, column 4)
   PV = $385,543.00

Problem 2

Assume that you would like to have $500,000 saved by the time you reach 50 and that you are 30 years old today. If you can earn an annual interest rate of 8%, how much should you invest today to reach your goal?

Solution:
To solve, calculate the present value of the amount you want to have at the end of the term using the present worth of $1 factors in the AH 505 annual compound interest tables with an annual rate of 8%. The term is 20 years (age 50 less your current age of 30).

- *PV* = *FV* × *PW*$1 (8%, 20 yrs, annual)
  PV = $500,000 × **0.214548** (AH 505, page 41, column 4)
  PV = $107,274.00

Problem 3

You would like to be able to withdraw $10,000 at the end of 5 years, and another $10,000 at the end of 10 years. If you can earn an annual interest rate of 5% on a deposit, how much should you deposit today?

Solution:
To solve, calculate the present values of the two planned withdrawals using the present worth of $1 factors in AH 505 for each of the two terms at 5% annual compounding; and then add the two results.

PV First Withdrawal

- *PV* = *FV* × *PW*$1 (5%, 5 yrs, annual)
  PV = $10,000 × **0.783526** (AH 505, page 29, column 4)
  PV = $7,835.26

PV Second Withdrawal

- *PV* = *FV* × *PW*$1 (5%, 10 yrs, annual)
  PV = $10,000 × **0.613913** (AH 505, page 29, column 4)
  PV = $6,139.13

You would need to deposit $7,835.26 + $6,139.13 = $13,974.39

Problem 4

Mr. Smith wants to borrow money from you to finance his new business. He promises to repay you in two installments: a payment of $5,000 two years from today, and a second payment of $10,000 four years from today. If the annual interest rate is 10%, how much would you lend Mr. Smith today?

Solution:
To solve, calculate the present value of each installment using the Present Worth of $1 factors in the AH 505 annual compound interest tables for each term (2 years and 4 years) at an annual interest rate of 10% and add them together.

First Installment

- *PV* = *FV* × *PW*$1 (10%, 2 yrs, annual)
  PV = $5,000 × **0.826446** (AH 505, page 49, column 4)
  PV = $4,132.23

Second Installment

- *PV* = *FV* × *PW*$1 (10%, 4 yrs, annual)
  PV = $10,000 × **0.683013** (AH 505, page 49, column 4)
  PV = $6,830.13

Total present value = $4,132.23 + $6,830.13 = $10,962.36

Problem 5

Two investments A and B have the following annual cash flows (*CF*). Which investment is preferred, given an annual interest rate of 5%?
(The initial cash flows are negative, indicating outflows, and the subsequent cash flows are positive, indicating inflows. All inflows occur at the end of the year.)

Year	Investment A	Investment B
0 (now)	- $5,000	- $5,000
1	+ $500	0
2	+ $2,500	0
3	+ $3,250	$6,000

Solution:
To solve, calculate the present value of the cash flow at the end of each year using the present worth of $1 factors in the AH 505 annual compound interest tables with an annual rate of 5% and then add all of the present values. Compare the sum of each investment to determine which has the higher present value.

		Investment A		Investment B	
Year	*PW*$1 @5%	*CF*	*PV*	*CF*	*PV*
0 (now)	1.000000	- $5,000	- $5,000	- $5,000	- $5,000
1	0.952381	+ $500	$476	0	0
2	0.907029	+ $2,500	$2,268	0	0
3	0.863838	+ $3,250	$2,807	$6,000	$5,183
Total PV			$551		$183

The present value of the cash flows from Investment A, $551, is higher than those from Investment B, $183, so Investment A is preferred.

Problem 6

Assuming all cash flows (CF) occur at the end of each year, determine the present values of each of the following two series of cash flows:

Series	CF_1 (End Yr 1)	CF_2 (End Yr 2)	CF_3 (End Yr 3)	Annual Rate	*PV*
1	$5,000	$5,000	$3,000	5%	
2	$3,000	0	$3,000	4%	

Solution:
To solve, calculate the present value of the cash flow at the end of each year using the present worth of $1 factors in the AH 505 annual compound interest tables with an annual rate of 5% for series 1 cash flows and 4% for series 2; and then add the present value of each cash flow in the series. The sum is the present value of the series.

PV of Series 1 (AH 505, page 29, column 4)

Year 1	$5,000	×	0.952381 (*PW*$1, 5%, 1 year, annual)	=	$4,761.90
Year 2	$5,000	×	0.907029 (*PW*$1, 5%, 2 years, annual)	=	$4,535.15
Year 3	$3,000	×	0.863838 (*PW*$1, 5%, 3 years, annual)	=	$2,591.51
			Total *PV*	=	$11,888.56

PV of Series 2 (AH 505, page 25, column 4)

Year 1	$3,000	×	0.961538 (*PW*$1, 4%, 1 year, annual)	=	$2,884.61
Year 2	0	×	0.924556 (*PW*$1, 4%, 2 years, annual)	=	0.00
Year 3	$3,000	×	0.888996 (*PW*$1, 4%, 3 years, annual)	=	$2,666.99
			Total *PV*	=	$5,551.60